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NOTES ON THE SANTA FÉ MARLS, AND SOME OF THE CONTAINED
VERTEBRATE FOSSILS.

BY E. D. COPE.

The palæontological and geological examination, conducted by the party of the U. S. Survey, west of the north meridian, Lieut. G. M. Wheeler in charge, has already, during the present season, developed facts of interest, some of which are noticed below. The exploration has extended to the extensive lacustrine deposit in the valley of the Rio Grande, which has been termed by Dr. Hayden the Santa Fé marls. This author describes the deposits as first appearing in the north near Taos, and continuing for an unknown distance southward, and occupying the valley between the Rocky Mountains on the east, and the Jemez range on the west, he regards it as late Tertiary, but without special determination or co-ordination with the other known lacustrine formations of this continent.

Abundant material having been obtained by the party, it is easy to determine the fauna, whose remains are entombed in it, to be a part of that already described by Dr. Leidy and the writer, as occurring in Dakota and Colorado, under the name of Pliocene. This conclusion is indicated by the presence of the genera *Hippotherium*, *Protohippus*, *Procamelus*, *Cosoryx*, *Merychys*, and known Pliocene species of other genera, among which may be mentioned *Canis*, *Aceratherium*, etc. In addition to species already known, a number new to science were obtained, of some of which descriptions are appended.

Martes nambianus, sp. nov.

Represented by a mandibular ramus which supports three teeth. The anterior blade of the sectorial is rather obtuse. The first premolar is one rooted; the second and third are without posterior coronal lobe, but exhibit small basal lobes, both anterior and posterior. The anterior of the second is rather elevated, and the entire crown is directed obliquely forwards. Canine compressed. Mental foramina below the second and third premolars.

Measurements.	M.
Length of three premolars . . . . .	.006
Elevation of anterior lobe of sectorial. . . . .	.002
Depth of ramus at anterior lobe of sectorial . . . . .	.003

This species is of smaller size than the *M. mustelinus*, Cope,¹ and the sectorial tooth less elevated and trenchant.

***Cosoryx ramosus*, sp. nov.**

Char. Gen.—Inferior molars prismatic, 3-3; the premolars all sectorial, last with short branch crests. Molars with basal intercolumnar tubercles. Horns superciliary, solid, branched.

This genus was indicated by Dr. Leidy from a horn of the species known to him, the *Cosoryx furcatus*, from the Pliocene beds of the Niobrara. The same, or a similar species, has left abundant remains in the Santa Fé marls, and, in connection with the more numerous *C. ramosus*, has enabled me to determine the dental and other characters of the genus.

After a careful examination of the horns of these species in my possession, those of eighteen individuals (at least I find that of ten where the basal portion is preserved), the beam has been broken off and reunited by ankylosis in six. In most of these the spot is marked by a ring of exostosed tuberosities, like those constituting the burr of the deer's horn. The fracture has taken place in every instance at a point as far above the frontal bone as the burr of deer is situated, and is irregular in outline, higher on one side than the other. In some of the specimens the smaller antlers are also broken, and exhibit a similar burr, but the terminal portion is usually lost. In one specimen, a broken antler is ankylosed in the usual manner of overlapping ends.

The horns are solid, the centre having a narrow spongy axis. The surface is dense, and marked by arterial grooves, but not pierced by noticeable foramina.

It is evidently a question whether this genus should be referred to the hollow or solid horned Ruminantia, to the *Bovidæ* or *Cervidæ*. The horns might be regarded as those of deer, were it not for the occasional specimens without burr, while the teeth are both cervine and bovine. We may here draw such inferences as we can respecting the nature of the covering of the horn. That the fractured beam should not be lost, indicates the presence of some kind of covering to retain it. That this covering was not horny, is probable from the fact that the horns are branched, a structure impossible to the *Bovidæ*, since antlers effectually prevent the usual mode of increase of horn by additions at the base and removal at the extremity. That such covering protected arteries,

¹ Hayden's Annual Report, 1874.

which aided in the production of the burrs, is also probable. We may thus believe it to have been dermal like that of the giraffe or the *Antilocapra* at the period of immaturity of its horny sheath.

It may be concluded then that the genus *Cosoryx* represents the ancestral type of the *Cervidæ*, and explains the origin of the remarkable type of horns of that family as follows: Ruminants with fixed horns of structure more dense and brittle than others of the same type, in their annual combats at the rutting season, very frequently broke the beams off not far above the base. The usual location of nutrition followed, which being annually repeated, became as periodical in its return as the activity of nutrition of the reproductive system. This activity ceasing, the horn being dense lost its vitality, the more so as the normal covering would have already perished in its distal portions. The natural consequence, the separation of the dead from the living bone by suppuration, would follow. This process would, however, probably require a longer time for the establishment of its periodical return than the fracture and attachment of the existing horn.

This appears to be the only explanation of the origin of the phenomena exhibited by the horns of the *Cervidæ*, and is suggested by the specimens of *Cosoryx* to be described.

Char. Specif.—This species is larger than the *C. furcatus*, Leidy, and exhibits two antlers instead of one, of which the first is given off at a point much further from the base than in that species.

The beam near the base is curved a little inwards, and is semi-circular in section, the outer face being slightly concave, the inner very convex. The base is situated a short distance within the free superciliary border. The beam becomes more cylindric, and then expanding in a fore and aft direction, gives off an antler at right angles, nearly parallel to the cranial axis. At a distance little over half the elevation of the first antler, the beam gives off a second, in a plane transverse to the axis of the skull. The terminal portion of the beam is cylindric, curved, and acute at the apex.

Mandibles with teeth of two species of this genus were found, the smaller of which, occurring with the other portions of *C. furcatus*, belong to it. The larger differs in the elevation of the interrescentic column of the first molar, which is worn into a loop at ordinary maturity; this may however be but an individual variation. The diastema is long, and the ramus of that point quite slender.

<i>Measurements.</i>										M.
Long diameter base No. 1	.	.	.	.	.	.	.	.	.	.016
“ “ “ “ 2	.	.	.	.	.	.	.	.	.	.020
Elevation of first antler from base No. 1	.	.	.	.	.	.	.	.	.	.080
“ of second antler from first No. 3	.	.	.	.	.	.	.	.	.	.042
Length of terminal part of beam No. 4	.	.	.	.	.	.	.	.	.	.095
“ of molars 2-5, No. 5	.	.	.	.	.	.	.	.	.	.037
“ of molars 4-5, No. 5	.	.	.	.	.	.	.	.	.	.022
“ of fifth molar	.	.	.	.	.	.	.	.	.	.012
Width of fifth molar	.	.	.	.	.	.	.	.	.	.006

Cosoryx teres, sp. nov.

Established on the connected frontal bones supporting the horns of one specimen, and represented by portions of horns of two others. The former individual is larger than any one belonging to the other species, and the species is doubtless the largest of the genus. The horns stand above the posterior part of the orbit, which excavates its base, and presenting a considerable face descending into the temporal or zygomatic fossa. There is no free superciliary rim outside of the base as in *C. ramosus*, Cope. The section of the beam near the base is a regular oval, the long axis directed longitudinally and a little outward in front. The beam is erect with a slight curvature outwards at the inner base only. So far as preserved it does not branch, but may do so in its distal portion which is lost. The tissue is more spongy interiorly than in the other species; supra-orbital foramen far within the superciliary border.

<i>Measurements.</i>										M.
Outer width between bases of horn cores	.	.	.	.	.	.	.	.	.	.112
Inner width between bases of horn cores	.	.	.	.	.	.	.	.	.	.055
Width of temporal fossa behind horns	.	.	.	.	.	.	.	.	.	.053
Long diameter horn core	.	.	.	.	.	.	.	.	.	.038
Short diameter horn core	.	.	.	.	.	.	.	.	.	.021
Length of part preserved	.	.	.	.	.	.	.	.	.	.033

This species was as large as the *Antilocapra americana* of the plains.

Hesperomys loxodon, sp. nov.

An entire mandibular ramus with all the teeth preserved, was found in the same deposits as the preceding species. Molars subequal, short-crowned, triturating surface sigmoid. The apices of the sigma on the inner side, tubercular, and anterior to the outer apices. First molar with an additional transverse crest in front. Incisor compressed, outer angle of enamel face rounded, smooth. Molar series oblique, rising anteriorly.

	<i>Measurements.</i>	<i>M.</i>
Length of molar series0050
“ of first molar0018
Depth below last molar (inner side)0030
“ below first molar0045
“ of incisor0015
“ as diastema0027

Panolax sanctæfidei, gen. et sp. nov.

Char. Gen. Molars prismatic, transverse, except the first and last, each divided by a plate of enamel extending transversely from the inner side. Anterior molar longitudinal; posterior molar composed of two columns.

This genus is represented by numerous teeth and portions of the cranium. It evidently belonged to the *Leporidae*, and is allied to both *Lepus* and *Palæolagus*. As the teeth are mostly separate, it is not easy to determine which is the posterior and which the anterior molar. Judging by the analogy of the known species, the determination as here made is correct; should the relations be reversed the species will be referred to *Palæolagus*.

Char. Specif. The teeth are curved, the convexity inwards. Inner face grooved, the groove occupied by cementum; the outer border compressed either without or with very shallow groove. First molar with triturating surface twice as long as wide with an entering loop of enamel on the inner side, anteriorly narrower. Last molar as wide antero-posteriorly as transversely, the shaft curved backwards; the posterior column sub-cylindric half the diameter of the anterior.

	<i>Measurements.</i>	<i>Inch.</i>
Diameter of middle molar	{ antero-posterior . . . . .	.093
	{ transverse . . . . .	.187
“ first molar	{ antero-posterior . . . . .	.140
	{ transverse . . . . .	.063
“ last molar	{ antero-posterior . . . . .	.100
	{ transverse . . . . .	.065
Length of crown of last molar	. . . . .	.250

This species is about the size of the northern hare.

Cathartes umbrosus, sp. nov.

Represented by numerous portions of nearly all parts of the skeleton, in excellent preservation. The beak from the frontal bone to near the apex is preserved; it displays the depression just anterior to the nares, which marks the anterior boundary of the

cere. The culmen is nearly horizontal to just beyond this mark, and then exhibits a gradual decurvature to the apex. The beak is strongly compressed, and the tomia strongly decurved, forming an open festoon, whose middle point marks one-fourth the length of the beak from the nares. The latter are directed obliquely downwards and forwards, narrowing anteriorly, and having a prominent inferior bounding ledge. The mandible is weak, the symphysis marking on half the length of the beak, from the anterior angle of the nares.

The bones of the anterior extremities exhibit large and powerful proportions as compared with the posterior, appropriately to capacity for sustained flight. The head of the humerus is much compressed, and the articular face is nearly divided into two by the deep bicipital groove. The head of the femur is small, and the rotular face, a wide and deep groove. The tibia is slender, the shaft much compressed, with a prominent ridge. The cuemial crest is short, and not produced downwards on the shaft. The distal posterior bridge is narrow and oblique. The tarso-metatarsus has a strong exterior crest which constitutes half the width of the shaft.

<i>Measurements.</i>				Inch.
Length of beak from base of culmen	{ axial }	.	.	1.90
“ from cere to apex		.	.	1.20
Depth of beak at culmen	.	.	.	.87
“ of pre-maxillary at festoon	.	.	.	.75
Length of symphysis	.	.	.	.69
“ of nares	.	.	.	.37
Width of palate at festoon	.	.	.	.50
“ of head of humerus	.	.	.	1.37
“ of condyles	.	.	.	1.13
“ of distal end femur	.	.	.	.94
“ of head of tibia	.	.	.	.81
“ of condyles of tibia	.	.	.	.66
“ “ of tarso-metatarsus	.	.	.	.75
Length of a first phalanx	.	.	.	1.12
“ of seven sacral vertebræ	.	.	.	1.87
“ of two dorsal vertebræ	.	.	.	1.12
Depth of a dorsal vertebra (total)	.	.	.	.93
“ “ “ to roof of arch	.	.	.	.44
“ of centrum of roof of arch	.	.	.	.25
Width of “ “ “	.	.	.	.32
Length of two cervical vertebræ	.	.	.	1.12
Depth “ “ to apex neural spine	.	.	.	.44
“ of articular face centrum	.	.	.	.17
Width “ “	.	.	.	.25